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SUMMARIES OF
CURRENT RECLAMATION STUDIES
BY THE ALBERTA FOREST SERVICE
(updated 1984)

Alberta
ENERGY AND NATURAL RESOURCES

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SUMMARIES OF
CURRENT RECLAMATION STUDIES
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Reforestation and Reclamation Branch
Alberta Forest Service
Dept. of Energy and Natural Resources

Edmonton, Alberta
updated January, 1984

The Alberta Forest Service, Department of Energy and Natural Resources has carried out field demonstrations in reclamation and operational reclamation projects for several years. Since 1978, a number of applied reclamation experiments have been established with the primary objective of finding the practical solutions to some of the operational problems encountered in the field by Forest Rangers.

The following represents summaries of the results of the field studies which are currently being undertaken by the Reforestation and Reclamation Branch.

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TITLE: Native grass seed mixture trials (1979)

PROJECT LEADER: H. Tomm

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: Luscar Ltd., and Scurry Rainbow Oil Ltd.

LOCATION: Abandoned Coal Mines Cadomin ($S\frac{1}{2}$ 32-46-23-W5M) and Adanac (LSD 10-24-6-4-W5M)

PROJECT DURATION: 1979 -

BACKGROUND: Sufficient data and experience have been gained to begin designing and field testing native grass seed mixtures. At each of two sites, separate but identical experiments were established (summer 1979) on raw and topdressed overburden materials. The experiments are designed to evaluate the effects of selected agronomic companion crops on the performance of native grass seed mixtures.

OBJECTIVES:

1) To evaluate the effects of five agronomic companion crop treatments on the performance of four native grass seed mixtures.

2) To evaluate the reclamation potential of each seed mixture at two high-elevation sites.

3) To compare the performance of the seed mixtures on raw and topdressed overburden materials.

RESULTS:

1) The companion crops tested did not have a significant effect on the performance of the native grass seed mixtures in any of the experiments. The effect of the companion crops on percent plant cover was significant in only one experiment (raw overburden experiment at Cadomin) in only one year (1981)

2) The different native grass seed mixtures tested significantly affected percent plant cover in all experiments except the topdressed overburden experiment at Adanac in 1980 and the raw overburden and topdressed experiments at Adanac in 1981.

3) Highest average percent plant cover was achieved by a seed mixture composed primarily of wheatgrasses (northern wheatgrass, bearded wheatgrass, slender wheatgrass and June grass).

4) Lowest average percent plant cover resulted from a seed mixture of alpine sheep fescue, June grass, interior bluegrass and spike trisetum.

5) The relative performance of seed mixtures was generally consistent among all experiments (raw and topdressed overburden experiments).

6) The cultivated grass-legume control mixtures generally produced more plant cover than the pure native grass mixtures although the differences among these treatments were significant in only one experiment (raw overburden experiment at Cadomin) in 1981.

7) Cultivated companion crops occurring as dominant species included meadow foxtail, timothy and creeping red fescue.

8) Slender wheatgrass, northern wheatgrass, bearded wheatgrass, alpine sheep fescue and, to a lesser extent, alpine bluegrass, were native grasses commonly rated as dominant species.

9) Creeping red fescue, timothy and crested wheatgrass were the dominant species of the cultivated grass-legume control mixtures.

REPORTS:

1) Russell, W.B. 1979. Native grass seed mixtures trials (establishment report).

2) Tomm, H.O. and W.B. Russell. 1981. Native grass and cultivated grass-legume seed mixture trials on subalpine coal-mined disturbances in Alberta. A progress report for 1980. ENR Report No. T/21-80, Forest Service, Alberta Energy and Natural Resources. 41 pp.

3) Tomm, H.O. 1983. Native grass and cultivated grass-legume seed mixture trials on subalpine coal mined disturbances in Alberta (in preparation).

TITLE: Native grass adaptability trial (Oil Sands)

PROJECT LEADER: H. Tomm

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: A.O.S.E.R.P. Facilities, Mildred Lake site, Fort McMurray

PROJECT DURATION: 1981 -

BACKGROUND: The native grass program for high-elevation reclamation has progressed to the point where superior species and lines have been identified for high-elevation reclamation. As an extension of the field adaptability trials, selected native and agronomic species were established on blended oil sands materials at the Mildred Lake research site.

OBJECTIVES: To compare and evaluate the performance of nine native and eight agronomic grass species in an oil sands reclamation situation.

RESULTS:

1) Laboratory germination tests were conducted for all species. Among the native species, only spike trisetum (*Trisetum spicatum)* germinated poorly (40 percent). Similarly, only slender wheatgrass (*Agropyron trachycaulum*) exhibited poor germination (59 percent) among the cultivated varieties.

2) Field emergence of seedlings varied significantly among species, even after correction for the predetermined laboratory germination rate. The large-seeded species, specifically the Agropyrons (both native and cultivated) exhibited superior emergence.

3) Poorest emergence was exhibited by alpine sheep fescue (*Festuca saximontana*) and "Nugget" Kentucky bluegrass (*Poa pratensis*). The seedling count was 8.4 percent of the potentially viable seeds for both species.

4) More native species than cultivated species exhibited poor emergence.

5) Superior plant cover after two growing seasons was exhibited by both native and cultivated *Agropyron* species. Other species showing good potential for revegetation include *Poa alpina* (a native species) and *Alopecurus pratensis*.

REPORTS: Tomm, H. 1982. Early Performance of Some Native and Cultivated Grasses on Oil Sands Mine Disturbance Materials. ENR Report: T/45 24 pp.

TITLE: Agronomic seed mixture trials

PROJECT LEADER: M.R. Islam and S.K. Takyi

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: Abandoned Cadomin Coal Mine (east), S½ 32-46-23-W5M

PROJECT DURATION: 1978 -

BACKGROUND: In June 1978, separate but identical trials were established on spoil and on spoil topdressed with 20 cm of mineral soil. The trials were designed to evaluate the effects of varying seed and fertilizer rates on the performance of an agronomic seed mixture. Assessments of plant cover, biomass, seedhead production, vigor, and thatch accumulation have been made during the six-year period.

OBJECTIVES:

1) To evaluate the main effects (and interactions) of four seeding rates and five fertilizer rates on the performance of an agronomic grass-legume mixture, recommended for the region by the AFS.

2) To evaluate the reclamation potential of the seed mixture in a high elevation environment.

3) To compare the performance of the seed mixture on raw and topdressed spoil materials.

RESULTS:

1) The seed-mix produced practically no plant cover and biomass on raw spoil without fertilizer during the six-year period. The spoil topdressed without fertilizer provided some plant cover and biomass but the quantity was too meagre and the quality was too poor to meet objectives of reclamation.

2) A steady increase in plant cover, biomass, thatch accumulation, seedhead production and better vigor of the species was generally achieved over the years when the spoil was topdressed with a mineral soil and fertilized.

3) Application of 80-40-80 fertilizer provided the highest plant cover on both spoil and spoil topdressed growing media.

4) No significant differences between 80-40-80 single and split application of fertilizer could be established in plant cover, biomass, seedhead production, vigor and other characteristics.

5) Seeding rates did not show any significant effects on overall performance of species. 60 kg/ha seemed to be the optimum seeding rate but 30 kg/ha may also be considered.

6) The quality of the species deteriorated and the quantity of cover and biomass production decreased during the fifth year in comparison with previous years due to severe nitrogen deficiency and low level of available phosphorus in the growth media as fertilization was discontinued in that year. Chlorosis and mortality of the grasses were most common.

   This trend was further aggravated during the sixth growing season as maintenance fertilization was not resumed in that year. The legume (white clover) sown with the grasses-mix had vanished in the third year.

7) Residual effect of fertilization, specifically of nitrogen and phosphorus, cannot last more than two years in this project environment.

8) In grasses seed-mix without adaptable legume species capable of nitrogen fixing, annual maintenance fertilization with light dosage of nitrogen and some phosphorus is essential until the sward is well-established to commence nutrient cycling.

9) Achievement of reclamation objectives for the Cadomin project is possible with a combination of grasses-legume ('Rambler' alfalfa) species proved superior adaptability to other species tested under 'Agronomic Grass and Legume Adaptability Trials' by the same investigators.

REPORTS:

1) Russell, W.B., and S.K. Takyi. 1979. The Cadomin reclamation research project: The first-year results (1978). Alberta Energy and Natural Resources Report No. 121. Edmonton, Alberta. 47 pp.

2) Takyi, S.K., and W.B. Russell. 1980. The Cadomin reclamation research project: Second-year results (1979). Alberta Energy and Natural Resources, Edmonton, Alberta.

3) Islam, M.R. and S.K. Takyi. 1983. The Cadomin reclamation project: Third, fourth and fifth-year results. Alberta Energy and Natural Resources, Edmonton, Alberta.

TITLE: Agronomic grass and legume adaptability trials

PROJECT LEADER: M.R. Islam and S.K. Takyi

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTION RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: Abandoned Cadomin Coal Mine (east), S½ 32-46-23-W5M

PROJECT DURATION: 1978 -

BACKGROUND: In June 1978, separate but identical trials were established on spoil and spoil topdressed with 20 cm of mineral soil. The trials were designed to test the adaptability of nine agronomic grasses and legumes and one agronomic grass-legume mixture. Assessments of plant cover, biomass, vigor, seedhead production and thatch accumulation during the first, second, third, fourth, fifth and sixth year have been made.

OBJECTIVES: 1) To evaluate the reclamation potential of nine agronomic grasses and legumes and one agronomic seed mixture in a high elevation environment.

2) To compare plant performance on raw spoil and topdressed spoil materials.

RESULTS: 1) All species developed a plant cover in the first growing season and most improved steadily and maintained relatively high level of vegetative productivity during the succeeding maintenance fertilization years, except alsike clover and sweet clover which by the end of the fifth year had almost disappeared and could not regenerate in the sixth year.

2) Most species achieved higher cover and biomass, displayed better vigor and seedhead production on spoil topdressed with a mineral soil than on raw spoil.

3) 'Rambler' alfalfa, all species-mix, bromegrass, creeping red fescue, 'Park' Kentucky bluegrass produced relatively the highest cover till the sixth year. Crested wheatgrass and timothy showed up well. However, deterioration in quality and reduction in cover and biomass productions of the grasses species that occurred in the fifth year due to acute nitrogen deficiency and low level of available phosphorus following discontinuation of maintenance fertilization in that year was further accentuated during the

sixth growing season (no fertilizer was applied in the fifth and sixth-year). Chlorosis and mortality of grasses were common.

4) Alfalfa and all species-mix (containing alfalfa) maintained superior vegetative yields, vigor, seedhead production and thatch accumulation even after stoppage of annual maintenance fertilization apparently due to nitrogen fixing ability of alfalfa.

5) 'Rambler' alfalfa should be considered a good legume in seed mixture for operational reclamation in similar environment.

6) Species-mix of grasses and alfalfa, as mentioned under No. 3, demonstrated to be the best adaptable species to meet the objective of this project.

REPORTS:

1) Russell, W.B., and S.K. Takyi. 1978. The Cadomin reclamation research project: First-year results (1978). Alberta Energy and Natural Resources Report No. 121. Edmonton, Alberta. 47 pp.

2) Takyi, S.K., and W.B. Russell. 1980. The Cadomin reclamation research project: Second-year results (1979). Alberta Energy and Natural Resources, Edmonton, Alberta.

3) Islam, M.R., and S.K. Takyi. 1983. The Cadomin reclamation research project: Third, fourth and fifth-year results. Alberta Energy and Natural Resources, Edmonton, Alberta.

TITLE: Native grass seed mixture trials.

PROJECT LEADER: S.K. Takyi

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: Cadomin Abandoned Coal Mine (east), S½ 32-46-23-W5M

PROJECT DURATION: 1978 -

BACKGROUND: Separate but identical trials were established on raw overburden and overburden topdressed with 20 cm of mineral soil. The trials were designed to evaluate the effects of varying seed and fertilizer rates and several nurse crops on the performance of a native grass seed mixture. Second-year assessments of plant cover have been made.

OBJECTIVES:

1) To evaluate the main effects (and interactions) of two seeding rates, three fertilizer rates, and four agronomic nurse crops on the performance of a native grass seed mixture.

2) To evaluate the reclamation potential of the seed mixture in a high elevation environment.

3) To compare the performance of the seed mixture on raw and topdressed overburden materials.

RESULTS:

1) The seed mixture produced very low plant cover (less than 2%) in the first growing season, on both growth media. There were improvements in the second growing season especially on the topdressed overburden.

2) The seeding rate and the fertilizer rate treatments had significant effects on the amount of plant cover produced in the first season. In the second season, fertilizer improved cover but the seeding rate effect was not significant.

3) Due to poor seedling establishment, the companion crop treatments did not significantly affect plant cover in the first growing season. In the second season, the legume-grass companion crop treatment increased plant cover on the topdressed overburden. Fertilizer effect was still significant in either growth medium.

4) In the second growing season, the companion crop treatment had no significant effect on the native species plant densities; fertilizer effect was significant only on the raw overburden; and the higher seeding rate gave a significantly higher plant density.

5) In the second growing season, *Agropyron trachycaulum* and *Festuca saximontana* dominated in each companion crop treatment on the raw overburden, and *A. trachycaulum*, *F. Saximontana*, and *Poa interior* were the dominant species with topdressing. On the raw overburden fertilizer treatment narrowed the ratio between *A. trachycaulum* and *F. saximontana*, and improved *P. interior* proportions.

6) The experiments were not fertilized in the 1982 and 1983 growing seasons. This seemed to have resulted in poor plant vigor in most of the treatments.

REPORTS:

1) Russell, W.B., and S.K. Takyi. 1979. The Cadomin reclamation research project: First year results (1978). Alberta Energy and Natural Resources. Report No. 121. Edmonton, Alberta. 47 pp.

2) Takyi, S.K., and W.B. Russell. 1980. The Cadomin reclamation research project: Second year results (1979). Alberta Energy and Natural Resources. Edmonton, Alberta.

TITLE: Native grass adaptability trials

PROJECT LEADER: S.K. Takyi

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: Cadomin Abandoned Coal Mine (east), S½ 32-46-23-W5M

PROJECT DURATION: 1978 -

BACKGROUND: In conjunction with the native grass genetic improvement program being conducted by the Genetics Department at the University of Alberta, this trial was established to evaluate the reclamation potential of selected native and agronomic grass species. Separate but identical trials were established on raw overburden and overburden topdressed with 20 cm of mineral soil. First and second year assessments of plant cover have been made.

OBJECTIVES:

1) To evaluate the reclamation potential of 13 native and 2 agronomic grass species in a high elevation environment.

2) To compare plant performance on raw overburden and topdressed overburden materials.

RESULTS:

1) Most species germinated well but all achieved less than 10% cover in the first growing season. In the second season, plant cover improved in most species.

2) Highest covers were achieved by northern wheat grass (*Agropyron dasystachyum*) on raw overburden (7.9%) and by slender wheat grass (*A. trachycaulum* 'Revenue') on topdressed overburden (9.8%). In the second season, *A. dasystachyum*, and *A. trachycaulum* gave the best cover on raw overburden; and *A. dasystachyum*, *A. subsecundum*, *A. trachycaulum*, and *Festuca rubra*, 'Boreal' (a check species) gave the best cover on topdressed overburden. In the second growing season, all but one species had tillered on the topdressed overburden, and all but four species had tillered on the raw overburden.

3) The experiments were not fertilized in the 1982 and 1983 growing seasons. This resulted in poor plant vigor in most of the species.

REPORTS:

1) Russell, W.B., and S.K. Takyi. 1979. The Cadomin reclamation research project: First-year results (1978). Alberta Energy and Natural Resources Report No. 121. Edmonton, Alberta. 47 pp.

2) Takyi, S.K., and W.B. Russell. 1980. The Cadomin reclamation research project: Second-year results (1979). Alberta Energy and Natural Resources, Edmonton, Alberta.

TITLE: Influence of roll-out mat mulches on the establishment of a vegetative cover on an unamended coal spoil

PROJECT LEADER: S.K. Takyi

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: East (Abandoned) Coal Mine, Cadomin, Alberta - Rocky Mountain Foothills (east), S½ 32-46-23-W5

PROJECT DURATION: Started in June 1979. To be maintained for up to ten years

BACKGROUND: The old coal mine at Cadomin is one of several in the Rocky Mountains and along the eastern slopes where many of the spoil heaps have not naturally revegetated several years after abandonment. The spoil heaps at the Cadomin mine (abandoned for over 26 years) have generally remained stable although approximately 95% of the heap areas have hardly any vegetative cover.

Agronomic grasses and legumes established and grew well in the first three months when fertilized in the experiments laid out at the Cadomin mine, even on the unamended spoil in June, 1978 (Russell and Takyi, 1979). The spoil materials are rather coarse, highly deficient in organic matter, and appear not to retain the mobile fertilizer nutrients for any length of time. Normally these spoils should be treated with amendments such as "top" soil, peat, wood chips, etc. before attempting to revegetating them if annual fertilization is to be eliminated sometime after establishment.

This field experiment proposed to examine alternative methods of revegetating the old spoil heaps by utilizing roll-out mat mulches which will decompose after grass establishment to provide the initial organic matter layer.

OBJECTIVES: 1) To evaluate the effects of roll-out mat mulches on the establishment of agronomic grass-legume seed mix on unamended coal spoil;

2) To measure plant growth and changes in some spoil properties and soil moisture regimes of the spoil as they relate to the types of mulches used;

3) To evaluate the influence of ridging and troughing in establishing a vegetative ground cover on unamended spoils;

4) To evaluate the influence of roll-out mat mulches, and ridging and troughing on survival and growth of lodgepole pine seedlings;

5) A secondary objective is qualitative comparison of the erosion control potential of the mats.

RESULTS: At the end of the first growing season the following were observed:

1) Percent plant cover was in the order: Hold/gro (92.0) > Excelsior blanket (67.0) > jute net (55.5) > no mulch (check, 41.8) > ridging (33.3 in ridges and troughs combined; 66.7 in troughs only). (The plants could not penetrate the Hold/gro.)

2) Each treatment showed dry matter production above the check in the following order: Hold/gro > Excelsior blanket > jute net > ridging > check.

3) Erosion control effectiveness was best in the Excelsior blanket and Hold/gro (nil to very minimal erosion) followed by jute net (very minimal erosion), ridging (minimal erosion), and check (light to moderate erosion).

4) Spoil temperatures were generally slightly lower under the roll-out mats, especially under the Excelsior blanket. Spoil moisture levels were very slightly better under the roll-out mulches.

At the end of the second growing season the following were observed:

1) Both dry matter production and percent plant cover were approximately twice as high in most treatments as was the case in the first season.

2) The superior advantage of Hold/gro in providing plant cover in 1979 was not evident in 1980. The least erosion control again occurred in the check plot where spoil movement exposed some of the rooting system. Data for subsequent years have been collected; these will be included in a five-year report.

REPORTS:

1) Takyi, S.K. 1980. Influence of roll-out mats and ridging on the establishment of plant cover on an unamended coal spoil. A progress report for 1979. Energy and Natural Resources Report No. T/20-79. Alberta Department of Energy and Natural Resources, Edmonton.

2) Takyi, S.K. and R.H. Leitch. 1981. Influence of roll-out mats and ridging on the establishment of plant cover on an unamended coal spoil. A progress report for 1981. Energy and Natural Resources Report No. T/20-80. Alberta Department of Energy and Natural Resources, Edmonton.

TITLE: Methods of establishing native grasses on coal overburden

PROJECT LEADER: S.K. Takyi

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: None

LOCATION: East (abandoned) Coal Mine, Cadomin, Alberta, S½ 32-46-23-W5M

PROJECT DURATION: Started in 1980.

BACKGROUND: The Forest Service and other agencies involved with reclamation research have carried out several field studies with native grass species collected from the eastern slopes of the Rocky Mountains in Alberta. The Forest Service field investigations have involved adaptability studies and seed mix studies on both amended and unamended disturbed sites. The seeds have always been provided by the Department of Genetics, University of Alberta. Several of the species being tested appear promising as revegetation materials.

Although the germination data from the all-native seed mix broadcast and raked into the soil in the experiments established in 1979 by W. Russell have not been analysed, results of experiments in which the native grasses were seeded by broadcasting and raking in 1978 (Russell and Takyi, 1979) gave generally very poor percent plant cover of the plots. This could have been the result of not having selected the appropriate seeding method for the native grasses to suit the seedbed conditions. It is perhaps of some significance to identify the appropriate seeding methods for the native species to suit the drastically disturbed soil.

OBJECTIVES: 1) To compare how different methods of seeding native grass seed mix affect establishment success on unamended coal spoil.

2) To evaluate the effects the different methods of seeding of native grass seed mix have on growth following the initial establishment.

RESULTS: At the end of the first growing season in 1980 differences in the germination were observed among the different methods of seeding. Simulated drilling was the best treatment, followed by the roll-out mats mulches placed over the broadcast seed. With hydromulching, better results were obtained when the seed

mix was broadcast and then hydromulched. Direct broadcast seeding gave poor results. (Data collected in subsequent growing seasons will be included in the Five-year report.)

REPORT: Takyi, S.K. 1981. Methods of establishing native grasses on coal overburden. First year report (1980). 22 pp.

TITLE: Influence of agronomic grass-legume seed mixtures on the establishment and growth of commercial softwood tree species.

PROJECT LEADER: Paul King

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: Reclamation Research Technical Advisory Committee

LOCATION: Fairfax Lake (Robb Area) and Lynx Creek (Blairmore Area)

PROJECT DURATION: 1979 - 1989

BACKGROUND: These two trials test the effect of agronomic grass/legume seed mixtures and application rates on the performance of interplanted white spruce and lodgepole pine.

1) To determine the effects of selected grass-legume seed mix compositions and application rates on the performance of interplanted lodgepole pine and white spruce.

2) To assess the performance of the grass-legume treatments.

3) To evaluate the erosion controlling potential of the plant covers.

4) To define an optimal balance between the amount of agronomic forage species cover required for effective erosion control and for an acceptable amount of competition with interplanted commercial tree species.

RESULTS: At the end of 1981 on both experimental sites, the survival of lodgepole pine and white spruce was independent of both grass-legume mixture and application rate treatments. At the Lynx Creek experimental site tree height and stem diameter growth performance was affected by the rate at which grass-legume seed mixtures were applied while at Fairfax Lake no such differences were observed. The differences in growth performance may be attributed to the uniformity of grass-legume stand establishment and/or differences in the moisture holding capacity between the two sites. Neither site had undergone appreciable erosion since the time of experimental establishment.

REPORTS: 1) Mihajlovich, M. 1979. The influence of agronomic grass-legume mixtures on the establishment and growth of commercial softwood tree species: (Establishment report) Alberta Forest Service.

2) King, P. and M. Mihajlovich. 1981. Influence of agronomic grass-legume mixtures on the performance of commercial softwood tree species - 1980 Progress Report.

3) King, P. 1982. Influence of agronomic grass-legume mixtures on the performance of commercial softwood tree species: Progress Report for 1981-1982. In Preparation.

4) King, P. 1983. Influence of agronomic grass-legume mixtures on the performance of commercial softwood tree species used in reclamation. Paper Presented At: Canadian Land Reclamation Association, 8th Annual Meeting, August 21-24. Waterloo, Ontario.

TITLE: Selection of woody plants for oil sands reclamation.

PROJECT LEADER: P. King and S.K. Takyi

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: Reclamation Research Technical Advisory Committee

LOCATION: Mildred Lake (Fort McMurray Area)

PORJECT DURATION: 1980 - Indefinite

BACKGROUND: In 1979 a simulated amended tailings sand site was established at Mildred Lake using native sand, mineral fines, and peat. The first of the exotic woody plant trials was established in 1980. The second exotic trials was set-up in 1981 as was the first native woody plant trial.

OBJECTIVES:

1) To conduct field research on native and adapted exotic woody plant species for survival and growth on simulated amended tailings sand materials.

2) Test ecotypes from native populations (which have invaded other disturbed sites in the oil sands area) for their survival and growth performance on simulated amended tailings sand materials.

3) To develop recommendations for genotypes which may be placed in nursery/greenhouse production for large scale reclamation.

RESULTS: The results of the exotic species trial established in 1980 have been very encouraging to date. Survivals and height growths have generally been very good.

The results of the exotic species trial established in 1980 have been fairly good. The survival and growth performance of Brooks #6, Northwest and Tristis #1 hybrid poplars and silverberry and Russian olive have been good. The survival of Walker hybrid poplar has been very poor.

In the native species trial established in 1981, the survival and growth performance to date of paper birch, dwarf birch, bog cranberry, crowberry, red osier dogwood, prickly rose, white spruce, black spruce, and jack pine has been good. The survival of aspen and thinleaf alder has been poor.

REPORTS: Progress Report in preparation.

TITLE: Selection and evaluation of native trees and shrubs for reclamation in the Rocky Mountain Eastern Slopes of Alberta.

PROJECT LEADER: P. King

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service; Alberta Tree Nursery And Horticulture Center

CO-OPERATING AGENCIES: Reclamation Research Technical Advisory Committee (Alberta Energy and Natural Resources)

LOCATION: Rocky Mountain Eastern Slopes

PROJECT DURATION: 1979 - 1991

BACKGROUND: Native trees and shrubs have been recognized as potentially useful plant materials for reclamation in Alberta. They provide food and cover for wildlife, contribute to the beauty of the landscape, furnish visual screens, provide ground cover for erosion control, and play an important role in nutrient cycling and other ecosystem functions.

In view of the many potential uses and values of native woody plants, the AFS is developing a research project to select and field test suitable species for reclamation purposes in the Eastern Slopes.

OBJECTIVES: The overall objectives for the programme are to:

1) To determine the adaptability of promising native tree and shrub taxa and populations to disturbed land environments in the Foothills and Rocky Mountains of Alberta.

2) To evaluate and select adapted populations for commercial timber production, wildlife habitat improvement, slope stabilization, and improvement of recreational use.

3) To determine the optimum seed propagation methodology for the candidate species.

4) To formulate prescriptions for establishing and maintaining the selected taxa for the above-mentioned uses.

The first phase of the programme is propagation testing. The specific objectives of this project are:

1) To develop seed collection and handling guidelines for candidate native woody species to ensure optimal seed maturity at collection and minimal loss in germinability.

2) To test various pretreatments or combinations of pretreatments (as indicated in a literature review) on seedlots of selected native woody plant species with the aim of maximizing germination levels.

3) To determine which candidate native woody species can be feasibly propagated from seed and identify those which may have to be propagated vegetatively.

4) To develop prescriptions for seed propagation methodology in candidate native woody plant species.

RESULTS:

1) The first phase of the pre-germination treatment testing has been completed. The successful tests included silverberry, prickly rose, Fendler woods rose, thimbleberry, red raspberry, and bearberry.

2) The second phase of the pre-germination treatment experimentation is currently underway.

3) Preliminary seed collection and handling guidelines have been developed. Future work may result in some modifications to these guidelines.

4) The candidate species for field testing have been selected and the seed collections of these species are complete. This aspect of the work may be incorporated into a joint government/coal industry currently being planned for the Eastern Slopes of Alberta.

REPORTS:

1) Parker, R.W. 1979. Ecology of selected woody plant species: a bibliography. Alberta Forest Service.

2) Russell, W.B. 1979. Survey of native trees and shrubs on disturbed lands in the Eastern Slopes. Alberta Forest Service.

3) King, P.J. 1980. Review of seed pretreatments required for germination of candidate tree and shrub species in the Eastern Slopes. Alberta Forest Service.

4) King, P.J. 1981. Report on seed collection programme: Work completed during 1980 and proposed 1981 project. Alberta Forest Service.

5) King, P.J. 1981. Seed testing project (experimental design for native woody plant seed testing). Alberta Forest Service.

6) King, P.J., W.B. Russell, G. Grainger and A. Straka. 1982. Evaluation and selection of native woody plants for reclamation in the Eastern Slopes of Alberta.

7) King, P., G. Grainger, and A. Straka. 1982. Germination Pretreatment Testing of Selected Native Shrub Species (Preliminary phase). Alberta Forest Service and Alberta Tree Nursery And Horticulture Center.

8) King, P., G. Grainger and A. Straka. 1983. Testing of Seed Pre-Germination Treatments For Selected Native Shrub Species. Energy And Natural Resources Report T/43

9) King, P., G. Grainger and A. Straka. 1983. Testing of seed pre-germination treatments for four rosaceae native to Alberta. Paper Presented At: Canadian Land Reclamation Association (Alberta Chapter) Meeting, February 23-24. Edmonton.

TITLE: Reclamation Survey of the Panther River Coal Exploration Disturbances - (Special Study)

PROJECT LEADER: H. Tomm

FUNDING AGENCY: Alberta Forest Service

LOCATION: Panther River Area (west of Sundre)

PROJECT DURATION: Completed

BACKGROUND: The Panther River coal exploration disturbances which date back to the 1950's are located in the eastern slopes of the Rocky Mountains. Reclamation of the 60 km of trails and other associated land disturbances were undertaken by the Alberta Forest Service in 1977 and 1978. All disturbed sites were recontoured to original topography, seeded and fertilized.

OBJECTIVE: To determine reclamation success, and the performance of the cultivated grasses and legumes in the seed mixture seeded in this area of high elevation.

RESULTS: Reclamation of the Panther River area can be considered successful in terms of revegetation and erosion control. Plant cover on most reclaimed sites equaled or exceeded the cover of nearby undisturbed plant communities. Vegetation was sparse on some rocky north-facing slopes above treeline; however, the surficial material of these sites is not susceptible to erosion. No evidence of erosion was found at the majority of sample points. Moderate mass erosion occurred where initial recontouring was inadequate while evidence of gully erosion was primarily found in proximity to natural watercourses. All eroded sites were considered capable of natural revegetation and/or stabilization.

Analyses of species composition and frequency of occurrence data suggests that creeping red fescue is a superior species for reclamation over a range of site conditions. Kentucky bluegrass is also a suitable species, preferably for cool and moist sites. Timothy and white clover should only be seeded below treeline, preferably on north-facing slopes for the former species, and on south-facing slopes for the latter species.

Native species as a group were an important component of plant communities on reclaimed sites. Natural invasion should therefore be encouraged, particularly native grasses on south-facing slopes above treeline.

Evidence of grazing was sporadic and without definite trends. Heaviest and most extensive grazing occurred above and below treeline, north aspect. The relatively low level of range utilization indicates that special management for this resource is not required.
(Project completed.)

REPORT: Tomm H. 1981. Reclamation Survey of the Panther River Coal Exploration Disturbances. Alberta Energy and Natural Resources, Edmonton, Alberta. 45 pp.

TITLE: Native grass broadcast seeding trial (TM-8b)

PROJECT LEADER: H. Tomm

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: Coleman Collieries Ltd.

LOCATION: Pit No. 2, Tent Mountain Coal Mine, SW 14-7-6-W5M

PROJECT DURATION: Terminated

BACKGROUND: In conjunction with the native grass genetic improvement program being conducted by the Genetics Department at the University of Alberta, this trial was designed to evaluate the effects of several seeding rates and fertilizer types on the performance of selected native grass species. Fifth year trial assessments have been conducted.

OBJECTIVES:

1) To evaluate the effects of five seeding rates and two fertilizer types on the performance of 18 native grasses (representing 12 species) and one cultivar.

2) To evaluate the reclamation potential of each species in a high-elevation environment.

RESULTS:

1) After five growing seasons, fescue species produced the highest ground cover in both the organic and inorganic fertilizer trials. Idaho fescue (*Festuca idahoensis*), alpine sheep fescue (*Festuca saximontana*) and red fescue (*Festuca rubra*) all achieved over 35% average plant cover in the inorganic fertilizer trial. Red fescue and alpine sheep fescue achieved a cover of 48 and 25%, respectively, in the organic fertilizer trial. Red fescue is, to date, the most successful species in terms of producing plant cover.

2) June grass (*Koeleria cristata*) also performed well on both trials relative to other species.

3) The wheatgrass species (*Agropyron sp.*) appeared to reach maximum productivity in the third growing season, declining somewhat thereafter.

4) *Stipa comata* gave the poorest results under both fertilizer regimes and was not present after the second growing season.

5) After five growing seasons, most species achieved higher cover and greater above-ground production when treated with inorganic rather than organic fertilizer.

6) Percent plant cover generally increased with seeding rate. However, varying the seeding rate had little effect on above-ground dry-matter production.

REPORTS:

1) Mihajlovich, M., and W.B. Russell. 1980. Tent Mountain reclamation demonstration plantings (1977 and 1978). Alberta Forest Service. 48 pp.

2) King, P.J. 1980. Tent Mountain reclamation demonstration plantings (1979). Forest Service Report, Alberta Energy and Natural Resources. 25 pp.

3) Tomm, H. 1982. Progress report on the Tent Mountain grass and legume trials. Forest Service, Alberta Energy and Natural Resources. 25 pp.

TITLE: Tent Mountain 10 - Agronomic species adaptability trial

PROJECT LEADER: H. Tomm

FUNDING AGENCY: Alberta Forest Service

AGENCY CONDUCTING RESEARCH: Alberta Forest Service

CO-OPERATING AGENCIES: Coleman Collieries Ltd.

LOCATION: Pit No. 2, Tent Mountain Mine, Sec. 14, Twp. 7, Rge. 6, W5M

PROJECT DURATION: Terminated

BACKGROUND: The massive slumping damage to Tent Mountain Trial 1 created a need for developing a second agronomic species adaptability trial on the Tent Mountain site. The replacement trials were established on the mine site in June of 1977.

OBJECTIVES:

1) To evaluate the adaptability of 16 agronomic grasses and 8 agronomic legumes to the high elevation mine site.

2) To evaluate and compare the performance of the 24 agronomic species when grown on raw overburden material and on overburden topdressed with mineral soil.

RESULTS:

1) After the initial growing season, all species germinated and produced some ground cover, "Leo" birdsfoot trefoil, and white and yellow blossom sweet clover exhibited poor development (less than 10 percent plant cover) on both the topdressed and raw overburden trials after five growing seasons. In addition, white clover, "Aurora" alsike clover and red clover fared poorly on the raw overburden trial. Similarly, "Parkway" crested wheatgrass, "Melrose" sainfoin and "Sawki" Russian wild rye produced sparse ground cover on the topdressed overburden trial.

2) The legumes, particularly red clover, "Aurora" alsike clover, and white clover fared better on the topdressed overburden material than on the raw overburden.

3) "Boreal" creeping red fescue and chewings fescue on both trials and arctic fescue on the raw overburden trial were the most successful species in terms of ground cover development after five growing seasons.

4) Most species produced more ground cover on the raw overburden material than on the topdressed material.

5) No distinction could be made between the two media after two years on the basis of above-ground dry matter production.

REPORTS:

1) Mihajlovich, M. and W.B. Russell. 1980. Tent Mountain reclamation demonstration plantings (1977 and 1978). Alberta Forest Service. 48 pp.

2) King, P.J. 1980. Tent Mountain reclamation demonstration plantings (1979). Forest Service, Alberta Energy and Natural Resources. 25 pp.

3) Tomm, H. 1982. Progress report on the Tent Mountain grass and legume reclamation trials. Forest Service, Alberta Energy and Natural Resources. 25 pp.

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